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NP-33-02-007-01

Docket No. 50-346

License No. NPF-3

November 14, 2003

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Ladies and Gentlemen:

LER 2002-007-01
Davis-Besse Nuclear Power Station, Unit No. 1
Date of Occurrence – April 24, 2002

Enclosed please find Revision 1 to Licensee Event Report 2002-007, which is being submitted to provide updated information on potential leakage of the Incore Monitoring Instrumentation Nozzles at the bottom of the Reactor Vessel. This issue was identified as part of the Davis-Besse Return to Service Plan inspections. This LER is being submitted voluntarily in accordance with the guidelines of Section 2.7 of NUREG-1022, Event Reporting Guidelines. Commitments associated with this LER are listed in the Attachment.

Very truly yours,

Lew W Myers

GMW/s

Enclosures

cc: Regional Administrator, USNRC Region III
DB-1 NRC Senior Resident Inspector
DB-1 Senior Project Manager, USNRC
Utility Radiological Safety Board

IE22

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## COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station in this document. Any other actions discussed in the submittal represent intended or planned actions by Davis-Besse. They are described only as information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8450) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

| COMMITMENTS | DUE DATE |
|---|---|
| 1. Perform a test of the incore nozzles to confirm that no leakage exists. This will be accomplished by raising the Reactor Coolant System to normal operating pressure, and maintain for approximately 7 days. Following this test, temperature and pressure will be reduced in order to perform a visual inspection of the bare metal of the lower reactor vessel for symptoms of incore nozzle leakage. | 1. Reactor Coolant System Normal Operating Pressure Test completed on October 4, 2003. |
| 2. Submit supplemental information regarding the apparent cause and safety significance of this occurrence. | 2. Completed with submittal of this revision of the LER. |
| 3. Perform a bare metal reactor vessel visual inspection for symptoms of incore nozzle leakage. | 3. During the Cycle 14 mid-cycle outage. |

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
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| Davis-Besse Unit Number 1 | 05000346 | 1 OF 5 |

TITLE (4)

Potential Leakage of Incore Monitoring Instrumentation Nozzles at Bottom of Reactor Vessel

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 04 | 24 | 2002 | 2002 | -- 007 -- | 01 | 11 | 14 | 2003 | | 05000 |
| | | | | | | | | | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |

| OPERATING MODE (9) | D | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11) | | | |
|---|---|---|---|---|---|
| POWER LEVEL (10) | 000 | 20.2201(b) | 20.2203(a)(3)(i) | 50.73(a)(2)(i)(C) | 50.73(a)(2)(vii) |
| | | 20.2201(d) | 20.2203(a)(3)(ii) | 50.73(a)(2)(ii)(A) | 50.73(a)(2)(viii)(A) |
| | | 20.2203(a)(1) | 20.2203(a)(4) | 50.73(a)(2)(ii)(B) | 50.73(a)(2)(viii)(B) |
| | | 20.2203(a)(2)(i) | 50.36(c)(1)(i)(A) | 50.73(a)(2)(iii) | 50.73(a)(2)(ix)(A) |
| | | 20.2203(a)(2)(ii) | 50.36(c)(1)(ii)(A) | 50.73(a)(2)(iv)(A) | 50.73(a)(2)(x) |
| | | 20.2203(a)(2)(iii) | 50.36(c)(2) | 50.73(a)(2)(v)(A) | 73.71(a)(4) |
| | | 20.2203(a)(2)(iv) | 50.46(a)(3)(ii) | 50.73(a)(2)(v)(B) | 73.71(a)(5) |
| | | 20.2203(a)(2)(v) | 50.73(a)(2)(i)(A) | 50.73(a)(2)(v)(C) | X OTHER |
| | | 20.2203(a)(2)(vi) | 50.73(a)(2)(i)(B) | 50.73(a)(2)(v)(D) | Specify in Abstract below or in NRC Form 366A |
| | | | | | Voluntary |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Gerald M. Wolf, Staff Engineer - Licensing | (419) 321-8001 |

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| SUPPLEMENTAL REPORT EXPECTED (14) | | EXPECTED SUBMISSION DATE (15) | MONTH | DAY | YEAR |
|---|---|---|---|---|---|
| YES (if yes, complete EXPECTED SUBMISSION DATE). | X NO | | | | |


ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 24, 2002, with the reactor defueled, visual inspections of the underside of the reactor vessel revealed corrosion deposits. The heaviest concentration of corrosion deposits was noted around the center and lowest reactor incore monitoring instrumentation guide tube. Two sets of deposit samples were taken and analyzed in an attempt to determine if the deposits were caused by one or more leaking incore nozzles, or as a result of runoff from cleaning of the reactor vessel closure head. However, no definitive conclusions could be reached with respect to the source of the deposits. An inspection was conducted in September 2003 to confirm that no leakage of the incore nozzles existed by raising the Reactor Coolant System to normal operating pressure, holding these conditions for approximately seven days, and then reducing conditions to perform a bare metal visual inspection for evidence of leakage. Based on the results of the Reactor Coolant System Pressure test, there was no identified leakage of the reactor vessel incore nozzles. Therefore, this issue had no safety significance. Since no incore nozzle leakage was identified, this condition was reported voluntarily.

DESCRIPTION OF OCCURRENCE:

Following the discovery of a large cavity in the Davis-Besse Nuclear Power Station (DBNPS) reactor vessel [AB-RPV] closure head, a Return to Service Plan was created to describe the course of action being taken for a safe and reliable return to service. Refer to DBNPS LER 2002-002 for further details of reactor vessel head leakage and resultant degradation. Included in this Return to Service Plan is the Containment Health Assurance Plan that focuses on the extent of the Reactor Coolant System leakage and any damage that may have resulted from the dispersion of boric acid leakage in the containment building. On April 24, 2002, with the reactor defueled, visual inspections of the underside of the reactor vessel revealed corrosion deposits. These deposits appeared to be the result of runoff from cleaning of the reactor vessel closure head. The heaviest concentration of corrosion deposits was noted around reactor incore monitoring instrumentation guide tube number 1, which is at the center of the reactor vessel and is the lowest point of the vessel. However, the possibility that these deposits could also have resulted from leakage of the incore monitoring instrumentation nozzles [AB-NZL] had not been discounted.

The DBNPS reactor vessel was manufactured by Babcock & Wilcox (B&W), and has 52 incore monitoring instrumentation nozzles that penetrate the lower portion of the vessel. Each of these incore nozzles is approximately three-quarters of an inch in diameter, fabricated from Alloy 600 material. These nozzles were welded to the reactor vessel using a partial penetration weld of Alloy 182 material, which was stress relieved following welding. As a result of a failure at another facility during hot functional testing, the nozzles in all B&W plants were subsequently modified using a full penetration Alloy 182 weld. Guide tubes are welded to these nozzles that contain incore detector assemblies [IG] for measuring neutron flux and temperatures in the reactor core.

Further detailed inspections of the underside of the reactor vessel were conducted using a magnetic wheeled crawler in order to keep personnel dose as low as reasonable achievable (ALARA). These inspections, completed on June 8, 2002, revealed:

- Boron and rust deposit trails observed on the sides and bottom of the reactor vessel
- Similar deposits observed on several incore nozzles
- Tape remnants and residue observed on incore nozzles
- No evidence of wastage on bottom of reactor vessel.

Samples were taken of the deposits on the underside of the reactor vessel and sent to a laboratory for analysis in an attempt to demonstrate that the flow trails and the incore nozzle deposits were from a common source. Fourteen distinct samples were taken; two from the "flow trails" observed on the side of

DESCRIPTION OF OCCURRENCE: (Continued)

the reactor vessel, and twelve from the deposits present on various incore nozzles. The laboratory analysis provided conflicting evidence and therefore it was inconclusive whether the flow trails on the bottom of the reactor vessel and the incore nozzle deposits had a common source.

In October 2002 additional samples were taken to provide further information for interpretation of reactor vessel lower head sample results. These samples included samples of adhesive tape and paint from the bottom of the reactor vessel, as well as four samples of the corrosion deposits on the reactor vessel hot and cold leg nozzles. The results of the analysis of these samples show that the tape and/or paint on the incore nozzles may have contributed to the differences between the flow trail and incore nozzle samples, and that significant differences existed between the compositions of the northwest flow trail and the hot and cold leg nozzle deposits. As before, no definitive conclusion could be reached from the available information to determine the source of the incore nozzle deposits.

At the time of the original report submittal, there was no confirmed leakage of the DBNPS reactor vessel incore nozzles. All testing performed was inconclusive regarding whether the deposits on the side and bottom of the reactor vessel had a common source. Therefore, this condition was voluntarily reported as a Licensee Event Report in accordance with the guidelines of Section 2.7 of NUREG-1022, Event Reporting Guidelines.

In September 2003, Reactor Coolant System pressure was increased to normal operating pressure and maintained for a period of approximately seven days. Following this test, the incore nozzle penetrations were visually inspected with a crawler video camera. This included a 360-degree inspection of each incore nozzle. The results of this inspection were compared with the results from the baseline inspection performed in May 2003, after the vessel was cleaned. No new boric acid deposits or other signs of leakage were found.

APPARENT CAUSE OF OCCURRENCE:

The boric acid deposits and corrosion observed on the underside of the reactor pressure vessel appeared to be the result of runoff from cleaning of the reactor vessel closure head during previous outages, or leakage of the refueling cavity seal. No other signs of leakage from the reactor vessel incore nozzles were found during the Reactor Coolant System Pressure test. Further information regarding inspections, analyses and testing performed prior to the Reactor Coolant System Pressure test to conclude there was no leakage from the incore nozzles was previously submitted to the NRC on July 30, 2003 via Serial Letter Number 2973.

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| Davis-Besse Unit Number 1 | 05000346 | 2002 | -- 007 -- | 01 | 4 OF 5 |

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

ANALYSIS OF OCCURRENCE:

The bottom of the reactor vessel operates at a lower temperature (approximately 558 degrees F) than the reactor vessel upper head (approximately 605 degrees F). Given this lower temperature and the duration of operation of the DBNPS, the incore nozzles would have a lower susceptibility for Primary Water Stress Corrosion Cracking than nozzles located on the reactor vessel upper head. At the time of original report submittal, visual inspections of these nozzles were not routinely conducted for plants in the United States, and inspections and testing at plants in France had not yet discovered any cracking or leaking of the incore nozzles. Subsequent to the original report submittal, visual inspection of the South Texas Project Unit 1 Reactor revealed evidence of leakage from two incore nozzle penetrations.

Based on the results of the Reactor Coolant System Pressure test, there was no identified leakage of the DBNPS reactor vessel incore nozzles. Therefore, this issue has no safety significance.

CORRECTIVE ACTIONS:

In September 2002, the bottom of the reactor vessel was thoroughly cleaned, removing the loose/peeling areas of coating on the lower reactor vessel along with all boric acid deposits. No corrective actions have been deemed necessary with respect to restoring the coating. The subject area cannot be properly prepared to meet design basis accident coating qualification requirements. Additionally, an engineering evaluation has been performed to verify the acceptability of not re-applying a coating to this area.

In September 2003, a test of the Reactor Coolant System was conducted to confirm that no incore nozzle leakage exists. This was accomplished by raising the Reactor Coolant System to normal operating pressure using non-nuclear heat from the operation of the Reactor Coolant Pumps. These conditions were maintained for approximately seven days. At the end of the test period, the Reactor Coolant System temperature and pressure was reduced, and a visual inspection of the bare metal of the lower reactor vessel was performed utilizing a crawler video camera to look for symptoms of incore nozzle leakage. The results of this inspection were compared with the results from the baseline inspection performed in May 2003, after the vessel was cleaned. No symptoms of leakage were found.

As a prerequisite to the Reactor Coolant System test, laboratory leak rate testing was performed to determine resultant boric acid residue/deposits as a result of potential incore leak rates. This laboratory testing was conducted to verify methods for detecting very small leaks, with a mockup being designed and built to measure leak rates at conditions very near to the normal operating pressure and temperature of the DBNPS Reactor Coolant System. Based on the results of this testing, if a leak path existed, it is highly likely that visible evidence of small leakage would be present on the outside of the incore nozzle immediately outside of the reactor vessel.

# LICENSEE EVENT REPORT (LER)
## TEXT CONTINUATION

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

CORRECTIVE ACTIONS: (Continued)

A bare metal reactor vessel visual inspection will also be performed during the upcoming Cycle 14 mid-cycle outage for symptoms of incore nozzle leakage.

FAILURE DATA:

There have been no LERs in the previous two years involving deficiencies with the incore monitoring instrumentation nozzles at the DBNPS.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

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CRs 2002-01430, 2002-01690, 2002-02498, 2002-02552, 2002-07059